

REMARKS

This application has been carefully reviewed in light of the Office Action dated November 5, 2003 (Paper No. 6). Claims 1 to 21, 23 to 30, 32, and 42 to 54 are pending in this application, with Claims 22, 31, and 33 to 41 having been cancelled. Claims 1, 2, 4 to 6, 8 to 10, 13, 15, 20, 21, 23, 28 to 30, and 42 have been amended, and Claims 45 to 54 have been added. Claims 1, 6, 10, 13, 21, 30, 42, 45 and 53 are in independent form. Reconsideration and further examination are respectfully requested.

Applicants thank the Examiner for the indication of allowable subject matter in Claims 13 to 20.

Applicants also thank the Examiner for the indication that Claims 3, 7, 22, 31 and 43 would be allowable if rewritten in independent form, including all of the limitations of the base claims. With regard to Claims 3, 7 and 43, Applicants have chosen not to rewrite the claims at this time since the base claims for each of Claims 3, 7 and 43 are believed to be allowable for at least the reasons set forth below. The limitations of Claims 22 and 31 have been incorporated into newly added independent Claims 45 and 53, respectively. Consequently, Claims 3, 7, 43, 45 and 53 are seen to be in condition for allowance.

In the Office Action, Claims 9, 15 and 20 were objected to because of a spelling error. Specifically, the Office Action states "Caesium Iodide" should read "Cesium Iodide."

In response, Claims 9, 15 and 20 have been amended to correct the minor informality. Reconsideration and withdrawal of this objection is respectfully requested.

Claims 1 and 6 were rejected under 35 U.S.C. § 112, second paragraph. Specifically, Office Action alleges that Claims 1 and 6, as being apparatus claims, contain method steps that are supposed to describe in detail the elements of the apparatus.

In response, Claims 1 and 6 have been amended to more clearly define the invention in terms of an apparatus. Accordingly, reconsideration and withdrawal of the § 112, second paragraph, rejection are respectfully requested.

Claims 1, 4 to 6, 8, 9, 30, and 32 to 39 were rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 6,469,307 (Takabayashi) in view of U.S. Patent No. 4,365,155 (Oi); Claims 10 to 12, 21 and 23 were rejected under 35 U.S.C. § 103(a) over Takabayashi in view of U.S. Patent No. 4,384,417 (Okamura); Claims 2, 24 to 29, and 40 to 42 were rejected under 35 U.S.C. § 103(a) over Takabayashi in view of Oi and further in view of Okamura; and Claim 44 was rejected under 35 U.S.C. § 103(a) over Takabayashi in view of Oi and further in view of U.S. Patent No. 6,160,259 (Petrillo). Reconsideration and withdrawal of the foregoing rejections are respectfully requested.

Independent Claim 1 as amended is directed to a radiation detector having a wavelength conversion member made of column-shaped crystal for converting radiation into light and a sensor panel for detecting light converted by the wavelength conversion member. The wavelength conversion member has a projection with a flat surface disposed in opposition to the sensor panel.

One feature of the invention therefore lies in the wavelength conversion member having a projection with a flat surface disposed in opposition to the sensor panel. The applied references are not seen to disclose or suggest this feature.

Takabayashi discloses a scintillator panel 2 that can be coupled to a flat panel sensor 32. The scintillator panel 2 includes a wavelength conversion member (scintillator 16) formed with columnar crystals of CsI. See Takabayashi, Abstract; Column 4, lines 9 to 14 and 46 to 49; and Figs. 1 and 5. However, Takabayashi is not seen to disclose or suggest at least the feature of a projected flat surface of the wavelength conversion member disposed in opposition to the sensor panel.

Oi is not seen to remedy the deficiencies of Takabayashi. As understood by Applicants, Oi discloses that a scintillator formed from a single crystal is cut to a predetermined shape and size, and smoothed through a well-known polishing method. See Oi, Column 2, lines 39 to 45. Although Oi teaches smoothing a surface of a scintillator, it does not teach coupling a sensor panel with the scintillator. As a consequence, Oi could not possibly describe that the scintillator's smooth surface is disposed in opposition to the sensor panel.

Claim 1 is therefore believed to be allowable over the applied art.

Independent Claim 6 as amended is directed to a radiation detector having a wavelength conversion member made of column-shaped crystal for converting radiation into light and a sensor panel for detecting light converted by the wavelength conversion member. The wavelength conversion member has a projection with a surface processed so as to be made parallel to a surface of the sensor panel.

A feature of the present invention therefore lies in the wavelength conversion member having a projection with a surface made parallel to the surface of the sensor panel. The applied references of Takabayashi and Oi are not seen to disclose or suggest this feature.

Takabayashi teaches a scintillator panel 2 including a wavelength conversion member (scintillator 16) having a columnar structure. However, Takabayashi is not seen to disclose that the wavelength conversion member has a projection with a surface parallel to the surface of the sensor panel. Rather, Takabayashi merely teaches that the scintillator panel 2 can be coupled to a flat panel sensor 32.

Oi is not seen to remedy the deficiencies of Takabayashi. As noted above, Oi discloses smoothing the scintillator surface, but does not teach coupling the scintillator with a sensor panel. Therefore, Oi could not possibly describe that a projection of the wavelength conversion member is parallel to the surface of the sensor panel.

Claim 6 is therefore also believed to be allowable over the applied art.

Independent Claim 10 as amended is directed to a scintillator panel having a wavelength conversion member formed on a substrate, where the wavelength conversion member has a projection with a flat surface at a side opposite to the substrate.

A feature of the present invention therefore lies in having a projection of the wavelength conversion member with a flat surface at a side opposite to the substrate. Takabayashi and Okamura are not seen to disclose or suggest this feature.

Takabayashi teaches a scintillator panel 2 having a wavelength conversion member (scintillator 16) of columnar structure, where the scintillator panel can be coupled to a substrate 10. See Takabayashi, Abstract; Column 4, lines 60 to 65. However, Takabayashi does not teach or suggest a projected flat surface of the wavelength conversion member disposed opposite to the substrate.

Okamura is not seen to remedy the deficiencies of Takabayashi. As understood by Applicants, Okamura discloses a ceramic scintillator having a sintered body

of a rare earth oxysulfide, and a rare earth oxide phase formed on the surface of the sintered body, wherein the mean surface roughness Ra is greater than or equal to 0.01 μm and smaller than or equal to 0.8 μm . See Okamura, column 3, lines 29 to 35. Although Okamura describes smoothing a surface of the scintillator, Okamura is not seen to teach a projection of the wavelength conversion member positioned opposite to the substrate.

Claim 10 is therefore believed to be in condition for allowance.

Regarding Claims 21, 30 and 42, independent Claim 21 as amended is directed to a method of manufacturing a scintillator panel having a wavelength conversion member formed on a substrate, the wavelength conversion member converting radiation into light. The method includes the step of making smaller projections formed on a surface of the wavelength conversion member of a column-shaped crystal structure.

Independent Claim 30 as amended is directed to a method of manufacturing a radiation detector having a scintillator panel provided with a wavelength conversion member for converting radiation into light and a sensor panel for detecting light converted by the wavelength conversion member. The method includes the step of making smaller projections formed on a surface of the wavelength conversion member of a column-shape crystal structure on a substrate, and bonding the scintillator panel with the sensor panel after the step of making smaller the projection.

Independent Claim 42 as amended is directed to an apparatus for manufacturing a scintillator panel having a wavelength conversion member for converting radiation into light. The apparatus includes means for detecting projections formed on a surface of the wavelength conversion member of column-shaped crystal structure formed on a substrate, and means for measuring a height difference of the projections. The

apparatus also includes means for comparing the height difference with a predetermined threshold value, and means for reducing the sizes of the projections in accordance with a comparison result.

A feature of the present invention therefore lies in forming smaller projections on the surface of the wavelength conversion member of a column-shaped crystal structure. The applied references of Takabayashi, Okamura, and Oi do not suggest or disclose this feature.

Although Takabayashi teaches a scintillator panel that can be coupled to a flat panel sensor 32 and substrate 10, it fails to disclose or suggest forming smaller projections on a wavelength conversion member.

Okamura is not seen to remedy the deficiencies of Takabayashi. As noted above, Okamura teaches smoothing a surface of a ceramic scintillator to have a roughness greater than or equal to $0.01\text{ }\mu\text{m}$ and smaller than or equal to $0.8\text{ }\mu\text{m}$. Okamura is not seen, however, to teach forming smaller projections on the wavelength conversion member of a column-shaped crystal structure.

Oi is also not seen to remedy the deficiencies of Takabayashi. As noted above, Oi teaches that a scintillator formed from a single crystal is cut to a predetermined shape and size, and smoothed through a well-known polishing method. However, Oi is not seen to disclose or suggest forming smaller projections on a wavelength conversion member.

Claims 21, 30 and 42 are therefore also believed to be allowable over the applied art.

Accordingly, based on the foregoing amendments and remarks, pending independent Claims 1, 6, 10, 21, 30, 42, 45 and 53 remaining under consideration are believed to be allowable over the applied references.

The other claims in the application are each dependent from the independent claims discussed above and are believed to be allowable over the applied references for at least the same reasons. Because each dependent claim is deemed to define an additional aspect of the invention, however, the individual consideration of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, the entire application is believed to be in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

Applicants' undersigned attorney may be reached in our Costa Mesa, California office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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